



RECEIVED

OCT 17 2003

Patent
Attorney Docket No. 033434-003

GROUP 3600

KJ
Sub
Spec
DN
10/21/03

METHOD FOR STRENGTHENING A GEAR WHEEL, AND A GEAR WHEEL

FIELD OF THE INVENTION

[0001] The invention relates to a method for strengthening a gear wheel, and a gear wheel thus produced.

BACKGROUND OF THE INVENTION

[0002] Gear wheels in cranes and lifting devices are highly stressed components. Experience has shown that, for example, driving gear wheels in jack-up systems for jack-up offshore platforms and driving gear wheels interacting with vertical toothed racks have a surprisingly short useful life. Their useful life is notably shorter than that of the interacting toothed racks, which is due to the fact that the gear wheel teeth are quite naturally exposed to a greater number of alternating loads than the teeth of the rack.

[0003] Studies have shown that the teeth of driving gear wheels in large structures are exposed to motions that ultimately cause fracture in the root of the tooth.

SUMMARY OF THE INVENTION

[0004] It is an object of the invention to provide a method and an apparatus for strengthening gear wheels, particularly, but not exclusively, large driving gear wheels that are used in cranes and lifting devices.

[0005] Based on the acknowledgment of the fact that the teeth are subject to breakage as a consequence of the alternating motions in the tooth itself, most notably in the roots of the teeth, it is proposed according to the invention to fix each individual tooth in the gear wheel in the circumferential direction in order to counteract the tooth motions during operations, i.e., that each individual tooth will be like a theoretical beam fixed at both ends.

[0006] According to the invention, a method is therefore proposed for strengthening a gear wheel, wherein each tooth is fixed like a theoretical beam between two extreme points, in that two strengthening rings, each shaped on its inside in conformity with the gear wheel teeth, are placed around the gear wheel.

[0007] It is especially advantageous if the rings are secured around the gear wheel in such manner that the rings will be firmly shrunk onto the gear wheel with a material-technical tensile/compressive strength within 80% of the 0.2% elastic elongation range of the material (steel).

[0008] According to the invention, a gear wheel is also proposed wherein each tooth is fixed like a theoretical beam between two extreme points, in that around each gear wheel there are fixed two strengthening rings, each shaped on its inside in conformity with the gear wheel teeth.

[0009] It is especially advantageous if the strengthening rings are shrunk on in such manner that the rings will remain firmly shrunk onto the gear wheel with a material-

technical tensile/compressive strength within 80% of the 0.2% elastic elongation range of the material (steel).

[0010] Each individual strengthening ring is designed in principle like an internal ring gear having teeth intended for engagement in the tooth pockets of the gear wheel, with clearance towards the base of the teeth of the gear wheel or clearance towards the base of the teeth of both the gear wheel and the ring.

[0011] The invention can be carried out in a particularly advantageous way by envisaging the toothed rim of the driving gear stretched out to a correspondingly larger circle, shrink fits being chosen for this circle in accordance with the ISO tables of limits and fits, and by making similar considerations for the ring.

[0012] The invention will now be described in more detail with reference to the drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Fig. 1 shows a gear wheel viewed looking towards the teeth.

[0014] Fig. 2 is a side view of a gear wheel.

[0015] Fig. 3 is a section taken from Fig. 1.

[0016] Fig. 4 is a section taken from Fig. 2.

[0017] Fig. 5 is a section of a gear wheel and ring in the area where they are secured together.

[0018] Fig. 6 is another section of a gear wheel and ring in an area where they are secured together.

DETAILED DESCRIPTION

[0019] The gear wheel 1 shown in Figs. 1 and 2 has a plurality of teeth 2 around its circumference. At each end side of the gear wheel 1 there is shrink-fitted a strengthening ring 3 and 4 respectively. Each ring 3, 4 is made in the form of an internal gear wheel with teeth 5.

[0020] The teeth are shaped to fit with the teeth 2 on the gear wheel 1, see in particular Fig. 4.

[0021] As can be seen from Fig. 1 and from the section in Fig. 3, each tooth 2 on the gear wheel 1 will be fixed like a beam between the two strengthening rings 3 and 4, and the rings 3, 4 will counteract motions of each individual tooth 2 in the circumferential direction when the teeth are subjected to forces due to interaction with another set of teeth on a gear wheel or a toothed rack (not shown).

[0022] As shown in Fig. 4, a clearance 6, 7 is provided between the tooth crest and the tooth base on/in the gear wheel and ring. This ensures a best possible flank contact between the teeth 2 and 5 as well as a reduction in the stress of radial forces, see also Figs. 5 and 6. In Fig. 6 there is a clearance 8 only between ring-tooth crest and ring-tooth base.

[0023] In order to achieve the best possible effect, each individual strengthening ring 3, 4 is fitted on/around the gear wheel 1 by producing/utilizing a tensile force within 80% of the permanent elongation limit of the material (steel). This is achieved by suitable sizing of each individual ring prior to fitting.

[0024] It is particularly expedient if, in this connection, it is possible to envisage the toothed rim stretched out to its correspondingly larger circle, shrink fits for this circle being selected in accordance with the ISO tables of limits and fits. Similar considerations are made for the strengthening rings.

[0025] The invention permits a reduction in the danger of fatigue fractures without the need to increase the size, and consequently the material consumption.

[0026] The described embodiments of the present invention are intended to be illustrative rather than restrictive, and are not intended to represent every possible embodiment of the present invention. Various modifications can be made to the disclosed embodiments without departing from the spirit or scope of the invention as set forth in the following claims, both literally and in equivalents recognized in law.